

Comparison of Different Microprocessor Controlled Knee Joints on the Energy Consumption During Walking in Trans-Femoral Amputees: Intelligent Knee Prosthesis (IP) Versus C-Leg

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The purpose of this study was to investigate the characteristic differences between the IP and C-Leg by making a comparative study of energy consumption and walking speeds in trans-femoral amputees. The subjects consisted of four persons with traumatic trans-femoral amputations aged 17 - 33 years who had been using the IP and were active in society. Fourteen able-bodied persons served as controls.

First the energy consumption at walking speeds of 30, 50, 70, and 90 m/min was measured when using the IP. Then the knee joint was switched to the C-Leg. The same energy consumption measurement was taken once the subjects were accustomed to using the C-Leg. The most metabolically efficient walking speed was also determined. At a walking speed of 30 m/min using the IP and C-Leg, the oxygen rate (ml/kg/ min) was, on average, 42.5% and 33.3% higher ($P < 0.05$) than for the able-bodied group. At 50 m/min, the equivalent figures were 56.6% and 49.5% ($P < 0.05$), while at 70 m/min the figures were 57.8% and 51.2% ($P < 0.05$), and at 90m/min the figures were 61.9% and 55.2% ($P < 0.05\%$). Comparing the oxygen rates for the subjects using the IP and C-Leg at walking speeds of 30 m/min and 90 m/min it was found that subjects who used C-Leg walked somewhat more efficiently than those who used IP. However, there was no significant difference between the two types at each walking speed.

It was also determined that the most energy-efficient walking speed for subjects using the IP and C-Leg was the same as for the controls. Although the subjects in this study walked with comparable speed and efficiency whether they used the IP or C-Leg, the subjects' energy consumption while walking with the IP and C-Leg at normal speeds were much lower than previously reported. This study suggested that the microprocessor controlled knee joints appeared to be valid alternative for improving walking performance of trans-femoral amputees.

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